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Carl Mitcham, Aleksandra A. Kazakova

Let Us Now Think Engineering: an Interview with Carl Mitcham

Carl Mitcham **–** Professor Emeritus of Humanities, Arts, and Social Sciences. Colorado School of Mines. 1005 14th St. Colorado School of Mines, Golden, CO 80401, USA; International Distinguished Professor of Philosophy of Technology. Renmin University of China; e-mail: cmitcham@mines.edu

Aleksandra A. Kazakova – Senior Lecturer. Gubkin Russian State University of Oil and Gas. 65 Leninsky Prospekt, Moscow, 119991, Russian Federation; Bauman Moscow State Technical University; e-mail: kazakovaz@mail.ru

Carl Mitcham is International Distinguished Professor of Philosophy of Technology at Renmin University of China and Professor Emeritus of Humanities, Arts, and Social Sciences at Colorado School of Mines in the United States. For more than four decades of his work in the field of philosophy of science and technology, he has made important contributions on its most controversial topics, including biotechnologies, IT, energy and many others. Of special interest is his philosophical and socio-historical study of engineering, which has become the area of his intellectual collaboration with V.G. Gorokhov. This year, Prof. Mitcham published a new book, “Steps toward a Philosophy of Engineering: Historical-Philosophical and Critical Essays”. In the interview Professor Mitcham discusses the developments in engineering profession and education and the changing role of engineering societies; the relationships between engineering, science and philosophy; the engineering cultures and the meaning of engineering in the modern culture.

Keywords**:** philosophy of engineering, engineering education, engineering societies, engineering ethics

AK: Dear Professor, let me start with the never-ending definitional debate. Engineering is an umbrella term for many activities: making, applying, maintaining technologies. The rise of software engineering and bioengineering are the signs of our time. Engineering has become so heterogeneous that there seem to be no “typical” engineers anymore, if they ever existed. What is for you the core essence of engineering profession?

CM: Thanks for your question. You are right to take this as a foundational question. I begin working from the definition given in the official Charter of the Institution of Civil Engineering (in the UK). Because I recognize that engineering is different in different countries and different contexts, I will speak of "English-speaking engineering". I do not know as much what is going on in France, Russia, or Germany. I know a little bit about China, and Chinese 工程 (*gongcheng*) is not the same as English "engineering".

The ICE Charter says that engineering is "the art of directing the great sources of power in Nature for the use and convenience of man". This definition has been very important to the ICE, so much so that on its 150th anniversary the organization revisited it with a special conference (which I chronicled in the Appendix to my new book) [Mitcham, 2019, pp. 365–384]. I went to the archives, to the hand-written little essay by Thomas Tredgold, which explains that the great resources in nature are revealed to the engineer by science. It says explicitly, that English-speaking engineering understands itself as an application of Baconian science. As application it is an "art", because it is making (and not just thinking), and the purpose is "use and convenience".

At this time in England, "use and convenience" had become a philosophical term. In "An Enquiry Concerning the Principles of Morals" (1751) David Hume says that the basis of morality is use and convenience. Making the world more useful and convenient for people is a virtue, because it makes physical life easier and more commodious. Just as science makes available to the mind what is going on in nature, engineering makes useful and convenient the material goods of the world and increases the ease of their management. Just as the goal of doctors is to provide health, and of lawyers to render justice, what engineers originally conceived of themselves as providing was material use and convenience.

Initially such an art was acquired through apprenticeship, just like in many other arts; there was little theory behind it. But what has happened over the course of last 200–300 years was that this art has become increasingly explicated, increasingly conscious, methodologized, and engineers have constructed for themselves significant bodies of both rule-of-thumb knowledge and engineering science as a new kind of knowledge informing their art. It is a philosophical challenge to sort out what is going on in this process of engineering knowledge production. My former colleague Gorokhov wrote extensively about it (see, e.g., "Engineering: Art and Science" [Gorokhov, 1990] – *AK*).

AK: I would like you to comment a little bit more on what you said about "English-speaking engineering" in its relations with the Baconian tradition. Is it consistent, the co-evolution of the English-speaking philosophy, science and technology? Can we link the "high" philosophies of empiricism, utilitarianism and pragmatism, which include ontology, epistemology, ethics and political thought, to the peculiarities of English-speaking engineering culture – its hands-on approach and the special role of apprenticeship?

CM: Yes, I think this is reflected in the educational program of English-speaking engineers. Of course, there was cross-fertilization at some point: French-speaking and German-speaking engineering added something. The French have different version of science which engineers are going to use – it is a more Cartesian, mathematical science. This more rationalist science influenced English engineers; even as

they criticized, they could not help but recognize some of the distinctive strengths of French engineering. American engineering, although influenced primarily by British traditions, has also selectively absorbed elements from especially French and German engineering practices. The pre- and post-World War II exodus of engineers from Germany to the United States could not help but infuse German engineering practices into American engineering, just like the immigration of German philosophers had an impact on American philosophy.

Let us take an example from the American system of manufacturing. American industrialists, such as Henry Ford (1863–1947), wanted to use division of labor, as it was developed in England. But they used division of labor together with interchangeable parts and the assembly line to produce new forms of convenience. With Ford, of course, it was the mass production of automobiles, a commodity peculiarly appropriate for a large, spread out and excessively individualistic country. Ford, as I'm sure you know, created the assembly line by adapting the dis-assembly line of the slaughterhouse, in which an animal carcass was hung on a moving track that carried it past a series of butchers, each slicing off a different cut of meat. Ford ran the dis-assembly line backward, starting with an automobile skeleton (the chassis) past a series of workers who drop in an axel, then an engine, then add tires, etc. until the finished product rolled out of the manufacturing plant and onto the street. What is useful and convenient for Americans will not always be the same as what is useful and convenient for the British maritime empire (e.g., textiles and ceramics).

With your reference to that distinctive American philosophy known as pragmatism you already hinted at another element in American engineering: its extreme individualism. American pragmatism goes beyond British empiricism to stress that the ideas need to be confirmed not just by experience but by functional utility. Additionally, pragmatist American culture tends to be quite individualistic. There is no real equivalent in the United States of the royally chartered Institution of Civil Engineers. Instead, there are multiple professional associations competing with each other for public recognition and power.

AK: Talking about professional societies and the national schools of engineering, I would like to ask, do you think we can talk of a "community of engineers" in the same sense as "scientific community"?

CM: I don't think so. The community of scientists rests on a transnational ideal of truth and method of knowledge production, whereas the community of engineers, who are always engaged in material building and economic production, will always be not only national, but also sectoral. The community of civil engineers in the United States is a real community, as is the community of bioengineers. But the community of bioengineers in the US is in competition with bioengineers in China, and both communities recognize this is the case, whereas bioscientists are not in some kind of material goods production competition. Of course, scientists compete in knowledge production, for example, to win Nobel Prizes, but it is not the same as competition of the companies and products. Knowledge is a non-rival good. Physical uses and conveniences are rival goods. Engineering communities are necessarily more rivalrous and even sector-limited, which is the reason why engineers have trouble speaking with a common public voice, especially in the United States.

Although medical doctors are segmented by specialization, they can all see themselves as members some overarching national medical association and speak with one voice. The brain surgeons are not in competition with heart surgeons, whereas mechanical or civil engineers are often in competition with electrical engineers. The sociology of engineering discloses this kind of rivalry, which is especially strong in the United States, because of the deeply individualistic American culture.

AK: The proliferation of engineering societies is interconnected with the standards, regulating the specialization in technical education. Back in 1905 John W. Lieb questioned in his presidential address to the American Institute of Electrical Engineers, how many professional societies at the national and regional level, do the USA really need [Lieb, 1905].

CM: You are correct. This has been a consistent debate within American professional engineering. What is taking place with ABET (a non-governmental organization to accredit engineering education programs, originally called the Accreditation Board for Engineering and Technology), which is becoming a de facto international accrediting agency, is unique in the history of engineering, and I am not sure where it will go. The most international professional engineering society is the IEEE (Institute of Electrical and Electronics Engineers), and it is interesting that from the early ages radio and electrical engineers were more international than mechanical and civil engineers. Radio waves do not remain within the national borders. Gorokhov was a radio engineer, and we once talked about this.

AK: Can we suggest then that software engineering will be even more transnational, or more globalized?

CM: That is an interesting question. I'm not sure about the answer and would need time to think about it more. But there are certainly efforts to decouple software from national economies, although I'm not sure this will ever succeed more than at the margins: as in the "open source" and "free software" movement.

AK: Is it one movement or movements with different ideologies? Eric Raymond (one of the leaders of Open Source Initiative) is libertarian, while Richard Stallman (Free Software) is leftist.

CM: You're right, these are not the same. Some years ago I wrote an article about this (a version is included as a chapter in my new philosophy of engineering book [Mitcham, 2019, pp. 119–137]) arguing for their synthesis as a "free and open source" software movement. But such movements are up against the vested powers of Microsoft and Google and more, a highly leveraged cartel determined to commodify software and cyberspace. Issues of information control and cybersecurity are inherently national and power related. Remember, too, that we are currently in the middle of political backlashes against globalization. The early 20th century utopian vision of electronic mass media as promoting democracy followed by late 20th century fantasies of Internet information freedom have less and less political philosophical purchase as the electronic media are colonized by corporations, governments, and special interests of all types (including those who have an interest in controlling knowledge access if not disseminating lies). The idea that "software wants to be free" seems just another ideological illusion (unless it means free to be manipulated).

AK: In the accelerationist debate these paradigmatic problems are discussed on very general level: whether the current sociotechnical transformations will lead to

the new kind of capitalism or some kind of post-capitalism. Do you think these visions of future inspire the everyday practices in software engineering, such as sharing or protecting the software?

CM: One of my TAs in China was a software engineer and worked in the industry for a while before changing for philosophy. I asked what she used to do then, and she answered: "Finding and fixing software bugs". That is what she said she did all day. She left software engineering for philosophy precisely because of the absence of philosophy in software engineering. People like Raymond and Stallman are few and far between.

AK: Let me return then to the special character of engineering and ask about distinctions between science, technology and engineering. You and many interdisciplinary science and technology studies (STS) scholars you quote accentuate the non-technological (social, cultural, political and economical) factors in engineering.

CM: I've already mentioned a distinction between science as knowledge production and engineering as building and material product creation. Although the two are increasingly fused in technoscience, it is still possible to distinguish them analytically. Now I would add another simple (perhaps simplistic) distinction between engineering as the agency that produces technologies, although in another sense "technology" includes all forms of engineering (as in the "Massachusetts Institute of Technology"). I also think it necessary to distinguish *techne*, technics, and craft from engineering and technology. It is a distortion of history to describe the builders of the pyramids or medieval cathedrals as engineers; "architects" was the traditional name for such builders. The word engineer did not come on the scene until the 1500s to name a new kind of architect.

Now with regard to "non-technological" or cultural factors of engineering, here is something that has struck me. Ethics seems to be outside of engineering. It is not like in medicine, where the concept of health is built right into the science of medicine. In every course in medical school, as in anatomy and physiology, there is a built-in notion of what is health. In law, the notion of justice is also built-in – if you study it, you make an assumption that the law is just, and then you try to figure out how to apply the law in particular cases. But in engineering school, the only purpose is "use and convenience", without much indication for what (except, perhaps, as having a job to make money). Engineers seem to be "guns for hire". Doctors are not guns for hire; they do not study to poison or hurt somebody, as well as lawyers normally do not study the law to break it. Gorokhov gave me this example: When the Soviet troops took over Siemens factory, a delegation of engineers, technicians, and workers came to ask: "When will you give us work?" They did not care who they worked for, they just wanted to work.

AK: In a survey of startup entrepreneur engineers in Russia, who were asked to range priorities in their work (such as economic rationale, public good, etc.), one of the top answers was "getting things done".

CM: It is the same in the United States. Engineers describe themselves as "problem-solvers", not caring too much what the problem might be. This is why teaching engineering ethics is so hard. Ethics is just something stuck on from outside, so engineers just naturally think: "This is not the core of what we do".

When I made this argument once at a meeting in London, David Blockley, the author of "Engineering: A Very Short Introduction" for Oxford University Press,

a person Aristotle might have described as a "great-souled" engineer, argued that I was terribly mistaken and that a core value in engineering is safety. Blockley has also written some basic texts on engineering safety. But while he is obviously to some extent correct, the fact that there is a whole field of engineering called "safety engineering", and not all the engineers study it, raises questions about its integration across the engineering disciplines. In some sense even safety can seem stuck on from outside. There are engineering projects in which a particular "use and convenience" requires the reduction in concern with safety, as when military engineers have to construct a bridge as quick as possible to enable an attack. Besides, safety would seem to play as important role in medicine as in engineering.

AK: Is there not a contradiction between a common consensus that engineering is a socially embedded activity, which you also have emphasized by speaking of English-speaking engineering, and a universal statement that engineering is always "problem-solving"? Before a problem can be solved, it must be defined.

CM: Yes, but this is the point: Engineers do not themselves define the problems they solve. They are given problems. And they can be given these problems in different ways by different societies in different social contexts. This is precisely what embeds engineering. Engineering does not so much embed itself and constitutes a kind of agency that leaves itself open to being embedded. Normally this takes place not so much individually as socially. Thus there can never be a socially non-embedded engineering although engineering can be analytically conceptualized in a non-embedded manner. It's like language. There is no language as such. There is only English or Russian or German. Yet still we can think conceptually about language as such.

AK: Then there is a very practical (didactical) question of how to integrate a course in engineering ethics into engineering education. Bucciarelli complains that the case-based courses in American technical universities often give simplistic views on decision-making in engineering practices [Bucciarelli, 2008]. In complex cases there is commonly an effort to disentangle the complexities in order to apportion individual responsibilities, which is quite unrealistic in large corporative or governmental R&D projects. Thinking in terms of individual responsibility needs to give way to some sense of distributed responsibility.

CM: Yes, I agree, responsibility is often fuzzy and fluid.

AK: What does this mean for teaching engineering ethics? Can we grasp the social complexities in such a short course? Should it include excursions into sociology, political philosophy, social psychology, organization theory and other disciplines that will make it more contextualized? How can we practically do it?

CM: Li Bocong, a Chinese philosopher of engineering colleague, argues that what engineering ethics should be and what it really is, is the ethics of collaboration and cooperation. That is what actually engineers need to learn: how to work with other people, taking their different interests and perspectives into account, the ethics of working in groups.

Similar to Bucciarelli, Li does not think teaching ethics codes should be the center of engineering ethics education. That is the reason he developed this whole field of sociology of engineering: to understand how engineering projects work. (He further argues that the Chinese term "gongcheng", usually translated as "engineering", would be better rendered as "engineering project".) In any engineering project there

are economic factors, limited resources, limited time, the staff you have – some people do not know some things and you need to distribute the tasks to the people who can handle things, all of which means some people will work more than others.

Incidentally, this is precisely why I have argued elsewhere that the most general fundamental principle for engineering ethics, meaning ethics not just for engineers themselves but for them and for all of us who live in an engineered and engineering dependent world, is a duty "plus respicere", to take more into account.

AK: This question of inequality of knowledge and control and distribution of responsibility at the working place is crucial for sociology of engineering labor, especially for Marxist thought. If we recall the cases from the "Capital", the engineers there do not represent technology as such, they represent technology in service to capital, and in case of controversy, they naturally take the side of capital, for example, concerning safety conditions [Marx, 1954].

CM: This is both true and important. I am afraid that not many engineers think about it. This subservience to capitalism is un-thematized in their thinking about their lives. At least, English-speaking engineers are just sucked into the capitalist vortex. But I would disagree with Bucciarelli to some extent. If not too artificially constructed, case studies can help students begin to appreciate the complexities of the context in which their engineering is embedded, including the cultural captivity of capitalism. I am just not sure how you could teach it other way.

AK: To do this right, wouldn't it require a preliminary course in history or sociology of engineering and technology?

CM: Yes, any modestly effective engineering ethics curriculum will need to include significant measures of the history and sociology of engineering and technology. But this is an up-hill battle and would require more engineering education reform than is likely, at least in the United States. For years I have argued that if engineers are going to be true professionals then engineering should be a professional degree like medicine or law. In the United States, in order to enter a medical school or a law school a person needs already to have earned an undergraduate degree in some field. History of technology would be an excellent undergraduate degree preparation for a professional engineering degree.

AK: Let us take an example of the historically flexible distinction between the technical and economic rationality. In the beginning of the 20th century, Thorstein Veblen with his technocratic progressivism projected that engineers might eventually emancipate technology from capital. Do you think there is some kind of new wave of this technocratic optimism now?

CM: Perhaps in digital technologies. I think that this is a kind of idea that is reproduced in different media. Look at Google or Facebook – they want to rule the world. But the paradox is that they want to do this to make capital. Google's motto is "Do no evil", perhaps implicitly admitting their evil abilities. Facebook's motto is "Move fast and break things". There is clearly a kind of technocratic confidence embedded in the mind sets of these Silicon Valley disrupters. Mark Zuckerberg is a free market fundamentalist who does not want to be regulated by the government because he thinks he can do things better than the government. He wants to use his technology to set his own agenda, probably genuinely believing he can make the world better.

AK: Have we ever witnessed this degree of implicit popularity of technocracy? The gurus of IT (Bill Gates and Steve Jobs, Larry Page and Sergey Brin, Mark Zuckerberg, Elon Musk) have become role models for a whole generation of computer scientists and software engineers. Is there historical precedence of such a public perception of engineering?

CM: It is an interesting question. Ford and Edison were heroes, Tesla was to some extent, but he was overwhelmed by Edison. John Roebling, the bridge builder, was a public hero.

AK: All of those named were entrepreneurs, right?

CM: Yes, we could call them entrepreneurial engineers or engineer entrepreneurs.

AK: In the English-speaking world we often find the metaphor of "engineering the future". We are often intuitively using expressions of this kind, such as "social engineering", "designing one's life", or "political technologies". What is your interpretation of this idea of an "engineered future", what does it mean?

CM: It is always difficult to predict the future; ultimately we have to wait on history to reveal it to us. For me, however, as best I can understand it in the present, it means turning the future into an engineering project. Everything becomes just another problem to be solved in the short term, with the solution inevitably creating another problem, and the cycle is repeated. Engineering, systems engineering, and especially engineering maintenance (an often overlooked dimension of engineering) replace cultivation and craft as the predominant forming, making, and caring activities. Politics is replaced by planning and policy. It is a world in which innovation follows innovation, creative destruction follows creative destruction, stimulated and managed by marketing and advertising. The engineered future includes what Edward Bernays, the father of public relations, called the "engineering of consent". (This is another dimension of social engineering that has been almost completely ignored but is well studied by Stuart Ewen in a series of important books beginning with "Captains of Consciousness: Advertising and the Social Roots of the Consumer Culture" [Ewen, 2008]). Nevertheless, we cannot at this point know what is going to come forth. An engineering future could take different forms, some perhaps more stable, attractive, flourishing, or consumatory (to adopt a term from John Dewey) than others. Or it might all simply fall apart under the weight of its own complexity. There could also be some kind of widespread reaction or rebellion against it. At this point we simply do not know. The best we can do is to try to stand back and reflect on the mutating turbulence in which we find ourselves.

AK: This leads us to the idea of global capitalism or globalization as convergence. You have been working in China for years. Could you describe your general impression of the Chinese engineering project? Will the process of unification in science, technology and business make it almost indistinguishable from the Western world? Or can there be some strong preservation of difference?

CM: Once again you ask very difficult questions. And I must qualify whatever I say, because my knowledge of China is rather superficial. I am aware, however, that there has been a long debate about modernization in China. In the late 1800s near the end of the Qing Dynasty, when Chinese experienced both the need for modernization to defend themselves against Western imperialism and fears of modernization as threatening their culture, the slogan was "Chinese knowledge for substance, Western

knowledge for application". The New Culture Movement in the 1910s aimed to transform Chinese culture: the new slogan was that Confucius had to be replaced by "Mr. Science" and "Mr. Democracy".

The triumph of Chinese Communism in 1949 seemed initially to achieve this transformation. But Mao Zedong Thought Communism (and Chinese Communism is not just Communism in China) radically distorted Western notions of both science and democracy. The catastrophic violence of the Great Leap Forward (1958–1962) and Cultural Revolution (1966–1976) might be described as engineering with Maoist characteristics. Although under Mao China developed nuclear weapons and intercontinental missiles the massive engineered transformation of the Chinese infrastructure of transport and communications did not begin until 1978 with the Reform and Opening of Deng Xiaoping. China now has more kilometers of high-speed rail transport than the whole rest of the world combined, and with a better safety record than Europe. The metro systems in cities such as Shanghai, Beijing, and other cities are some of the best that exist. Beijing is a showcase for postmodern architecture.

The early 2000s, however, saw initiations of a revived interest in traditional Chinese culture, especially in Confucianism but also in Daoism and Buddhism. In 1987 the contemporary philosopher Li Zehou had turned the Qing slogan around to propose "Western knowledge as substance, and Chinese knowledge for application". Western science and engineering can be decorated with Chinese culture. At the Beijing Olympics in 2008, Chairman Hu Jintao promoted the Confucian and Daoist values of harmony. To what extent is the contemporary revival of Confucianism, Daoism, and Buddhism able to be integrated with science and engineering remains a question. This is a question that exists in all cultures that are being transformed by technoscience: in Japan, in Russia, in Germany, in France, even in the United States.

Take a concrete case like the Japanese tea ceremony, a ritual traditionally practiced with handmade pottery cups. Can this ceremony be retained with industrially mass produced tea cups? The Japanese philosopher Yanagi Soetsu argues that it cannot, that the ceremony depends on anonymous craft traditions. To what extent is this true or just a nostalgic romanticism? American philosopher Albert Borgmann's distinction between thing and device is one of the most important efforts to engage with such questions. I am not sure about the answers.

AK: We could also ask whether it is possible to differentiate a commitment to some traditional practices, in a grassroots effort to preserve a lifeworld, from localization in marketing.

CM: Yes, there are many distinctions to sort out here. It will take time to do so. We must also recognize the attachments that people feel toward their local cultures, how uncomfortable and disoriented they feel without a distinctive culture that bonds them to others. They seem to need both the distinction and the bond of decoration in order to feel stabilized in their worlds.

There is today some reaction against the modernist building boom in Beijing and some efforts to rebuild some of the old traditional *hutongs*. Some modern conveniences are introduced. There are no longer public baths that everyone has to share, but the narrow alleyway streets remain, and the rooms are constructed with what looks like the same kind of brick, although of course the brick is now industri-

ally mass produced. To live in a reconstructed *hutong* is a kind of reaffirmation of being Chinese but with a difference, modernized.

AK: This leads us to the question of philosophical anthropology. The early Industrial Revolution was reflected in the metaphors such as "Man a Machine" by La Mettrie, and now, in the age of the digital revolution, there is a wide-spread metaphor of the mind as a computer. More than just imagining AI as human, this transforms our image of human consciousness into a program. Does this de-humanize or can it be a new level of human self-realization?

CM: Once again, I am not sure. I think it will take time for us to understand what is happening to us, what we are doing to ourselves with our engineering and re-engineering of the world. The protagonist of Arthur Koestler's novel "Darkness at Noon" (1940) is a Bolschevik arrested during the Great Purge and accused of treason. In the midst of the changes taking place around him, he compares himself to an ape, hanging on the tree and looking down at the newly evolved creatures who stand upright and walk on two legs. He imagines how hard it would be for such an ape to understand the new way of life that is emerging around him. I sometimes ask myself, in my questioning of what is happening around me, am I still just hanging on the trees? Yet it does seem to me that we are reaching a self-destructive point. The big indication of this is what we are doing to the natural world. The fantasy of becoming AI or AI taking over does not take into account that we ultimately remain dependent on a fragile and relatively (not perfectly) stable non-human environment. We are both intentionally and unintentionally destabilizing the larger encompassing world so much that it is hard to see how we are going to survive.

But let me comment more generally on the question of philosophical anthropology. Here the issue is ultimately to what extent humans are properly or best understood as tool makers and users. In regard to this issue I would recommend the work of André Leroi-Gourhan whose "Le geste et la parole" (1965) provides one of the deepest reflections on technics and technology over the broad sweep of human history from prehistoric times to the contemporary world. And yet he never explicitly thematizes engineering. When reading this book (in its English translation, Gesture and Speech [Leroi-Gourhan, 1993]) with a small group of students in China last year, I found myself repeatedly saying to myself, "Let us now think engineering". I don't think we have yet adequately thought what engineering is and the full extent of its central role in the mutation of history that is taking place all around us.

AK: The last question, which I am afraid may be more difficult than the previous ones. If you were in David Hilbert's position, trying to attract attention and consolidate intellectual efforts of the scientific community, what would you say are the major problems for philosophy of technology of the 21st century?

CM: The great challenge is speed and a need to slow things down. All the grand challenges are speeding things up. A few years ago I wrote a short piece about this, "Speeding Things Down" [Mitcham, 2018]. The pace or speed of life today is so disruptive. Recall that for Martin Heidegger, the horizon of being is time. My life occupies a span of time, and during this time span I become aware of many things, but not everything, because the time is limited. It takes us time right now to have this conversation, and we have to slow down every now and then and say: "Wait a minute, I want to come back to this", or: "I did not say that right". We need

time to think and to get to know each other. We are too often being forced by the pace of engineered change to do things more quickly than we can comprehend.

AK: Dear Professor Mitcham, thank you for this thought-provoking talk. You are very welcome to visit Russia for further in-depth exchange of ideas with our philosophical and techno-scientific communities.

CM: My thanks to you as well and I sincerely hope that this will be only the beginning of our exchange on these topics.

Осмысление инженерии: интервью с Карлом Митчемом

Митчем Карл – доктор философии, почетный профессор. Горная школа Колорадо. США, CO 80401, г. Голден, 14-я улица, д. 1005, Горная школа Колорадо; Народный университет Китая; e-mail: cmitcham@mines.edu

Казакова Александра Андреевна – старший преподаватель. РГУ нефти и газа им. И.М. Губкина. Российская Федерация, 119991, г. Москва, Ленинский пр., д. 65; МГТУ им. Н.Э. Баумана; e-mail: kazakovaz@mail.ru

Карл Митчем, почетный профессор Народного университета Китая и Горной школы Колорадо в США, уже более сорока лет работает в области философии науки и техники, участвуя в дискуссиях по наиболее острым проблемам биотехнологий, информационных технологий, этическим вопросам энергетики. Особый интерес представляют его философские и социокультурные исследования инженерной деятельности, изданные в прошлом году в авторском сборнике «На пути к философии инженерии: историко-философские и критические эссе». В интервью обсуждается предметное поле и основные темы философии инженерии, в институционализации которой Митчем принимает активное участие: эволюция инженерной профессии и образования и деятельность инженерных сообществ; взаимоотношения инженерии, науки и философии; разнообразие инженерных культур и роль инженерии в культуре.

Ключевые слова: философия инженерии, инженерное образование, инженерные сообщества, инженерная этика

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